



RPUG
Road Profile Users' Group

2024

April 29 - May 2



ST. AUGUSTINE
FLORIDA

New Technology For An Old World

EVALUATION OF SURFACE CHARACTERISTICS ON FLORIDA'S CONCRETE TEST ROAD AND LONGITUDINAL GROOVING PROJECT

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OBJECTIVES

- Florida's US 301 concrete test road
 - Evaluate the surface characteristics of three different surface textures (LDG, FDOT's bridge deck and NGCS) in terms of friction, macrotexture, noise and international roughness index (IRI).
- I-95 in Brevard County, Florida
 - A pilot longitudinal grooving project was selected to study friction and macrotexture



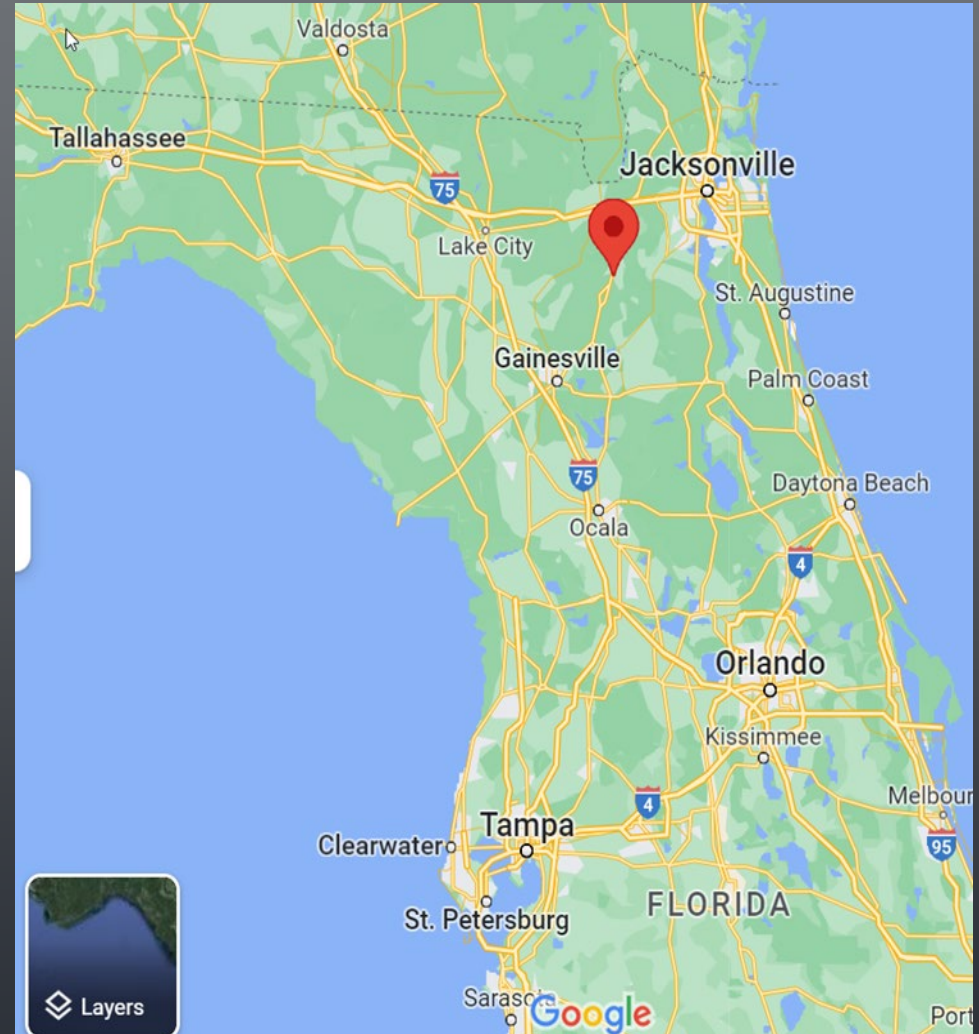
Florida Concrete Test Road US 301 Lawtey, Florida



FLORIDA CONCRETE TEST ROAD



- Clay County, SR 200 / US 301
- Adjacent to existing NB lanes
- 4-lane rural arterial with 40 ft. median, 31% trucks, design speed of 70 mph
- 2.5 miles of two-lane roadway running parallel to existing northbound lanes.
- NB traffic diverted to adjacent concrete test road
- Existing NB asphalt road will provide alternate traffic lanes during dynamic testing and performance evaluation periods
- WIM station & Data Building at south end of test road



TEST ROAD RESEARCH NEEDS

- Structural Experiment
 - Appropriate thickness
 - New base options
 - RAP as a concrete aggregate
- Drainage Experiment
 - Edge drain effectiveness
- Calibration Experiment
 - ME design method
- Alternative Surface Textures
 - Friction, texture and noise



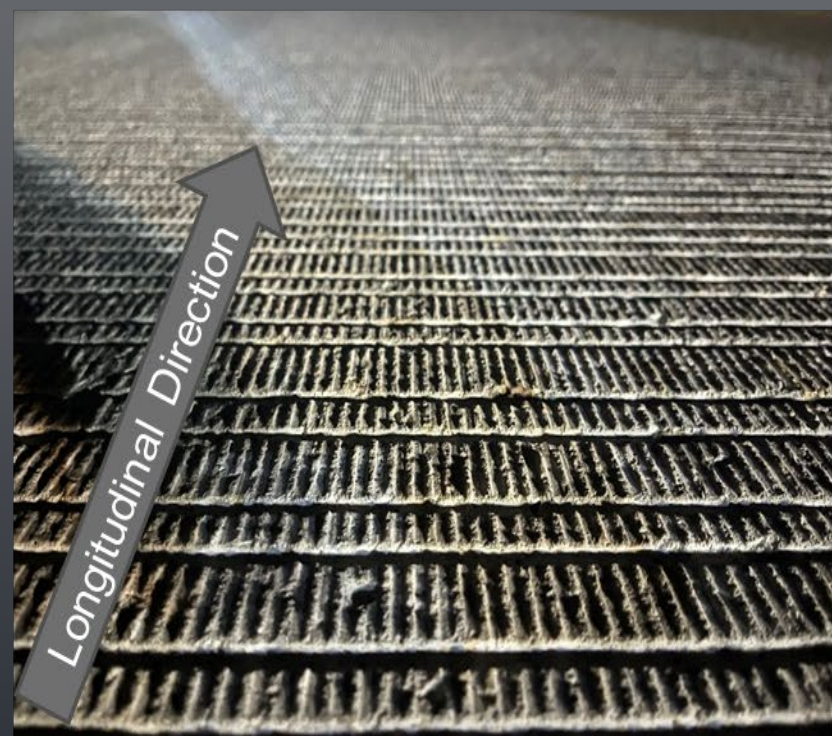
SURFACE TEXTURES OF FLORIDA'S CONCRETE TEST ROAD



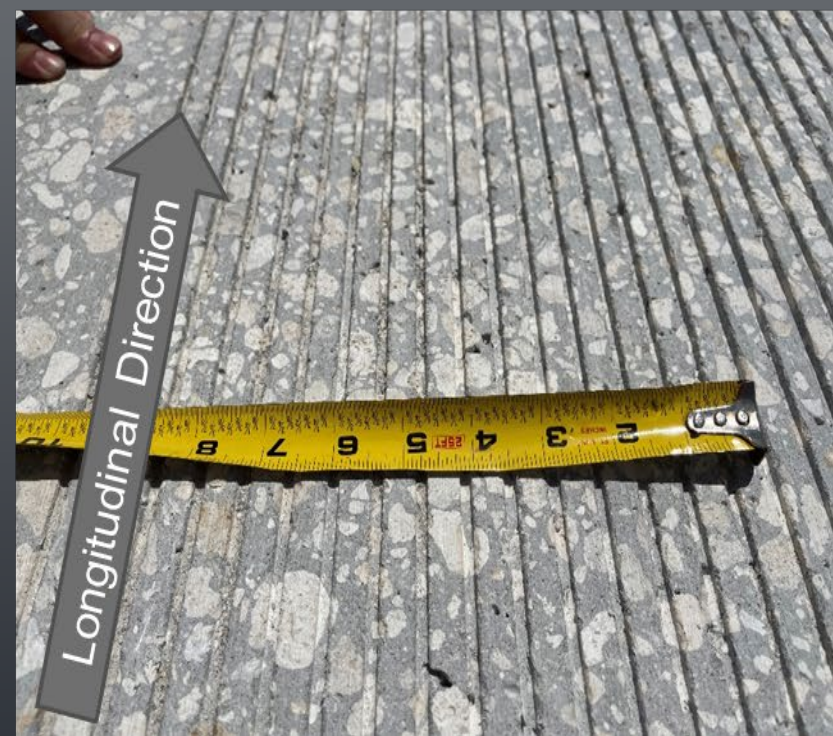
Longitudinal Diamond Grind (LDG)



Standard Bridge Deck Texture (Bridge)



Next Generation Concrete Surface (NGCS)



LONGITUDINAL DIAMOND GRINDING (LDG) SURFACE TEXTURE



- Longitudinal Diamond Grinding (LDG) is required for all rigid pavements (Section 352-4).
 - 1/10" diamond blades width
 - 1/32" height of peak ridges
 - 60 Blades/Foot

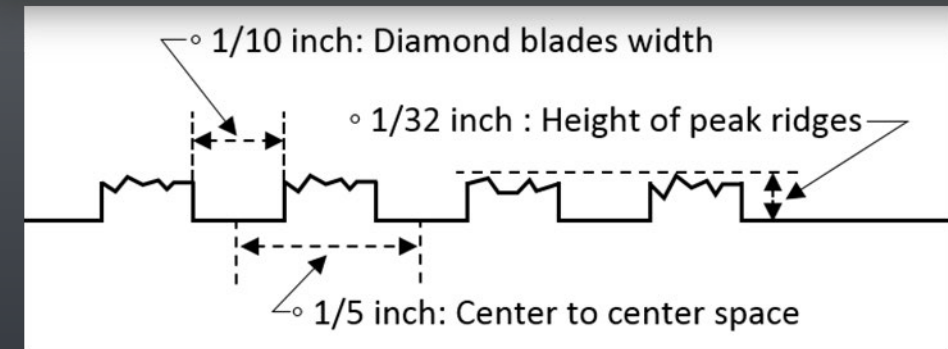


Figure A. Schematic section drawing for longitudinal diamond grinding texture

FLORIDA BRIDGE DECK SURFACE TEXTURE



- LDG + Transverse Grooving
 - Longitudinal Grinding
 - Transverse Grooving
 - 1/8" wide
 - 3/16" deep
 - Groove Spacing
 - 3/4", 1-1/8", 5/8", 1", 5/8", 1-1/8", 3/4"
 - in 6" repetitions

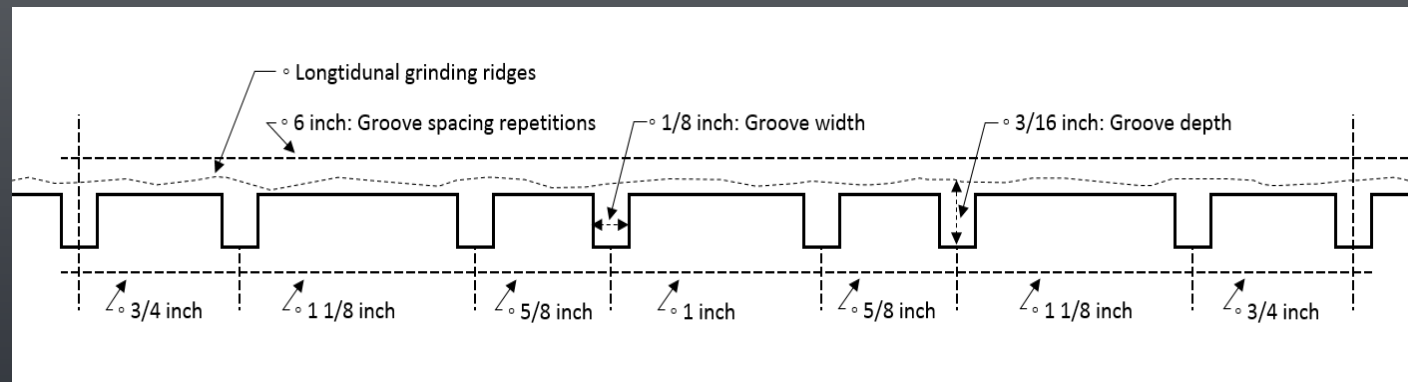
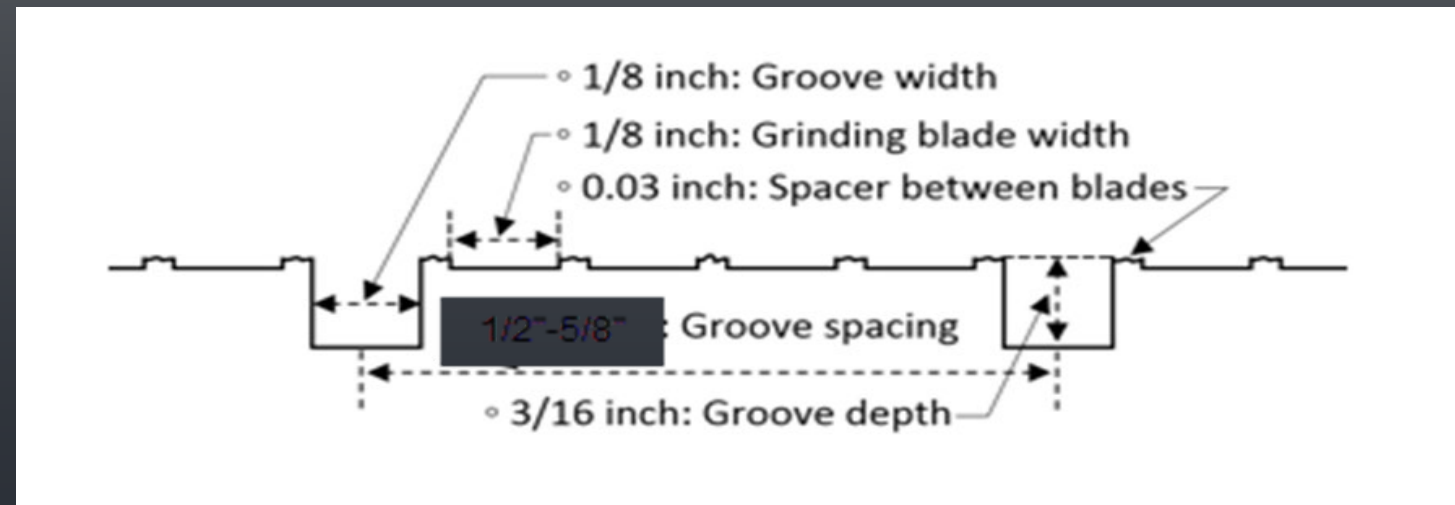
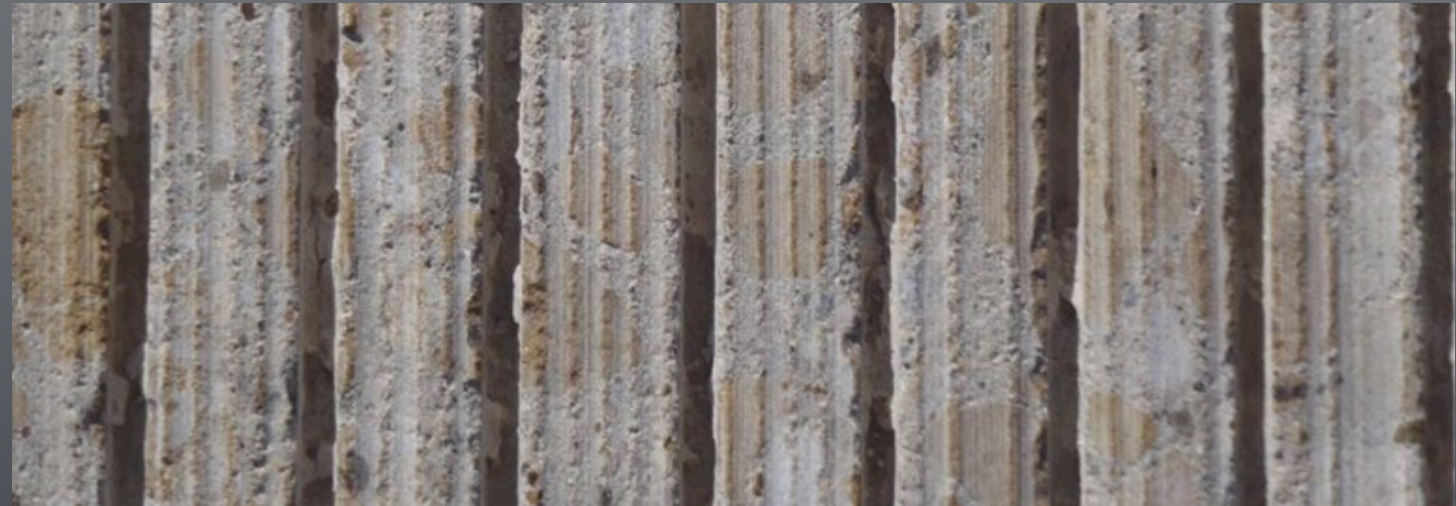


Figure B. Schematic longitudinal section drawing for diamond grinding with transverse grooving

NEXT GENERATION CONCRETE SURFACE

- Longitudinal Grinding
 - 80-85 Blades/Foot
- Longitudinal Grooving
 - 1/8" Wide Groove
 - 3/16" Depth
 - 1/2" to 5/8" Groove Spacing



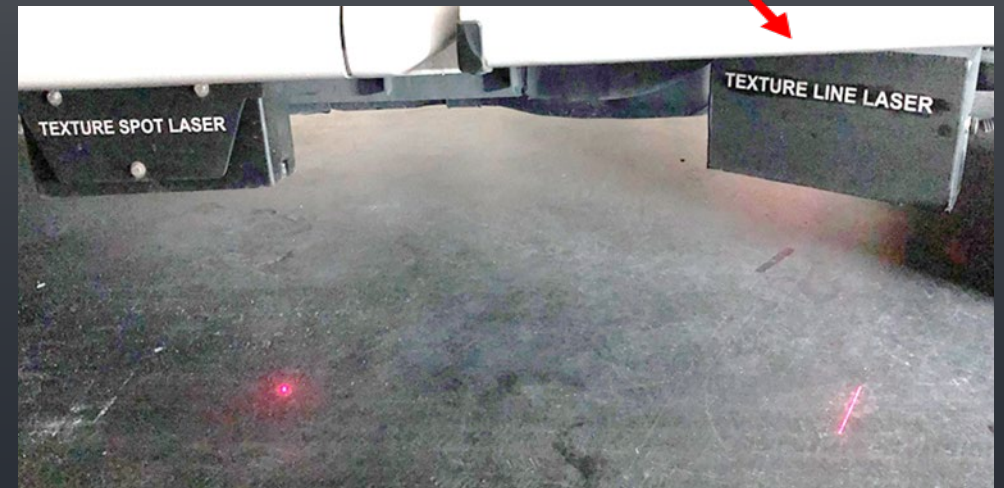
EVALUATION PLAN

- Locked Wheel Friction
- Surface Texture
- Noise
- Roughness



LOCKED-WHEEL FRICTION TESTER

- Friction collection is in accordance with ASTM E274. Friction Number (FN40) is reported.
- Texture collection is in accordance with ASTM E1845 Mean Profile Depth (MPD) is reported.



OBSI AND WAYSIDE NOISE

- On-Board Sound Intensity (OBSI) noise collection is in accordance with AASHTO T-360. Intensity level (dBA) is reported.
- Wayside noise collection is in accordance with AASHTO TP 98. Intensity level (dBA) is reported.



HIGH-SPEED LASER PROFILER (HSLP)



- Smoothness collection is in accordance with FM 5-549 “Measuring Pavement Longitudinal Profiles Using a High-Speed Inertial Profiler.” International Roughness Index (IRI) is reported.



TEST SECTION AND SET UP



TEST SECTION GROUPS

Group	Sections	Texture	Length m (ft)
1	1-5	NGCS	342.9 (1,125)
2	6-10	Bridge	342.9 (1,125)
3	11-15	LDG	342.9 (1,125)
4	16-20	NGCS	312.4 (1,025)
5	21-25	Bridge	342.9 (1,125)
6	26-30	LDG	342.9 (1,125)
7	31-36	NGCS	411.5 (1,350)
8	37-41	Bridge	359.1 (1,178)
9	42-46	LDG	360.3 (1,182)
10	47-52	NGCS	431.6 (1,416)

TEST SET UP

Test Method	ASTM/AA SHTO/FM	Test Speed km/h (mph)	Number of Groups	Number of Tests	Total Tests
LWT	ASTM E 274	48 (30)	10	2	20
		64 (40)	10	2	20
	ASTM E 501	80 (50)	10	2	20
		97 (60)	10	2	20
	ASTM E 274	48 (30)	10	2	20
		64 (40)	10	2	20
	ASTM E 524	80 (50)	10	2	20
		97 (60)	10	2	20
Line Texture Laser	ASTM E1845	48 (30)	10	2	20
OBSI	AASHT T- 360	97 (60)	10	3	30
Wayside	AASHTO TP-98	97 (60)	3	2	6
HSLP	FM 5-549	48 (30)	10	2	20

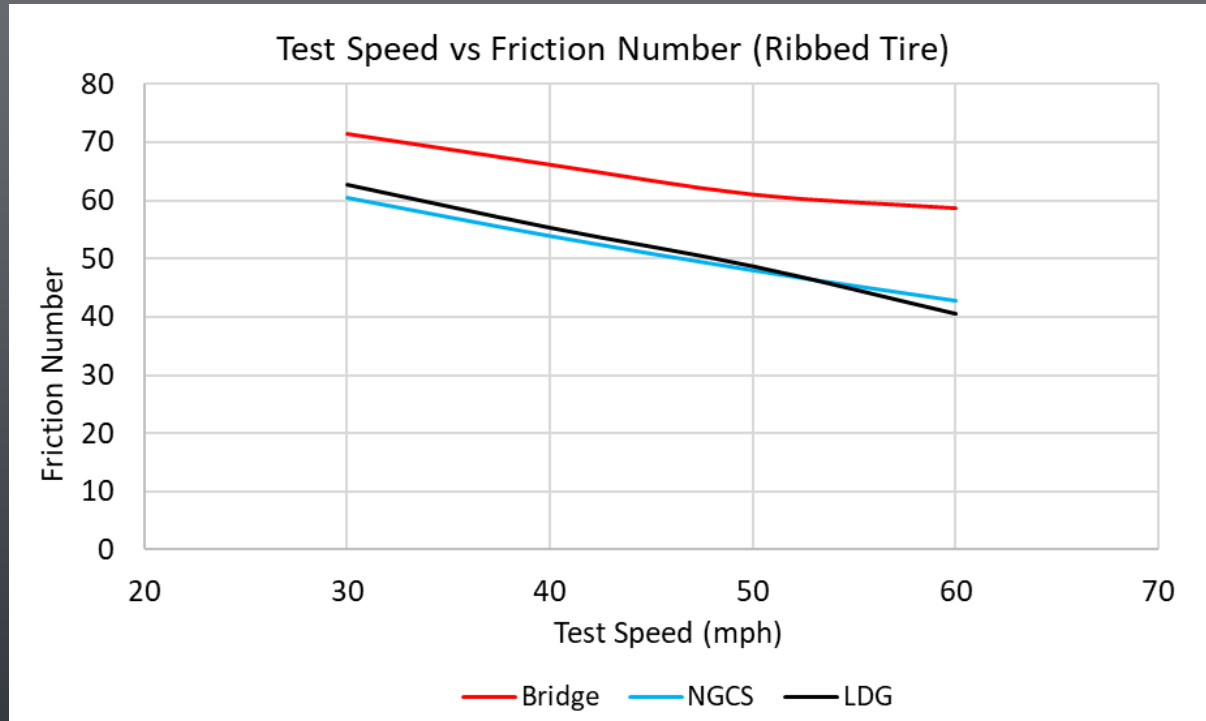


Results and Discussions

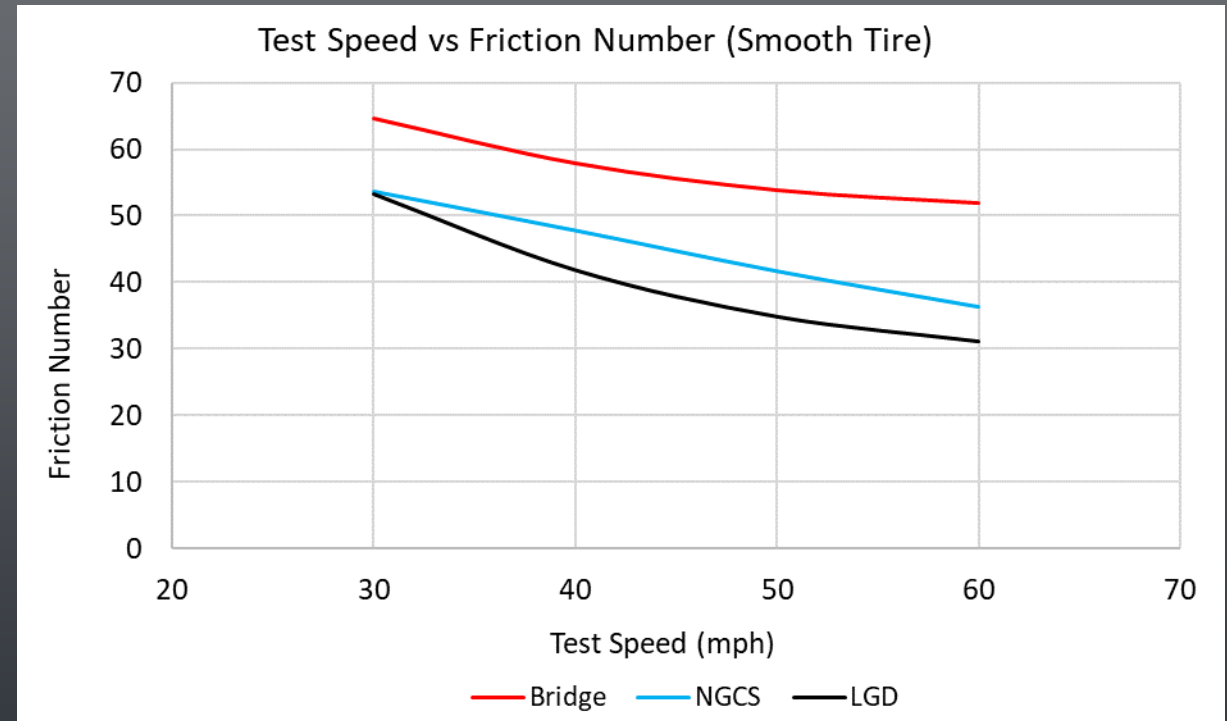
TEST SPEED VS FRICTION NUMBER



Ribbed Tire

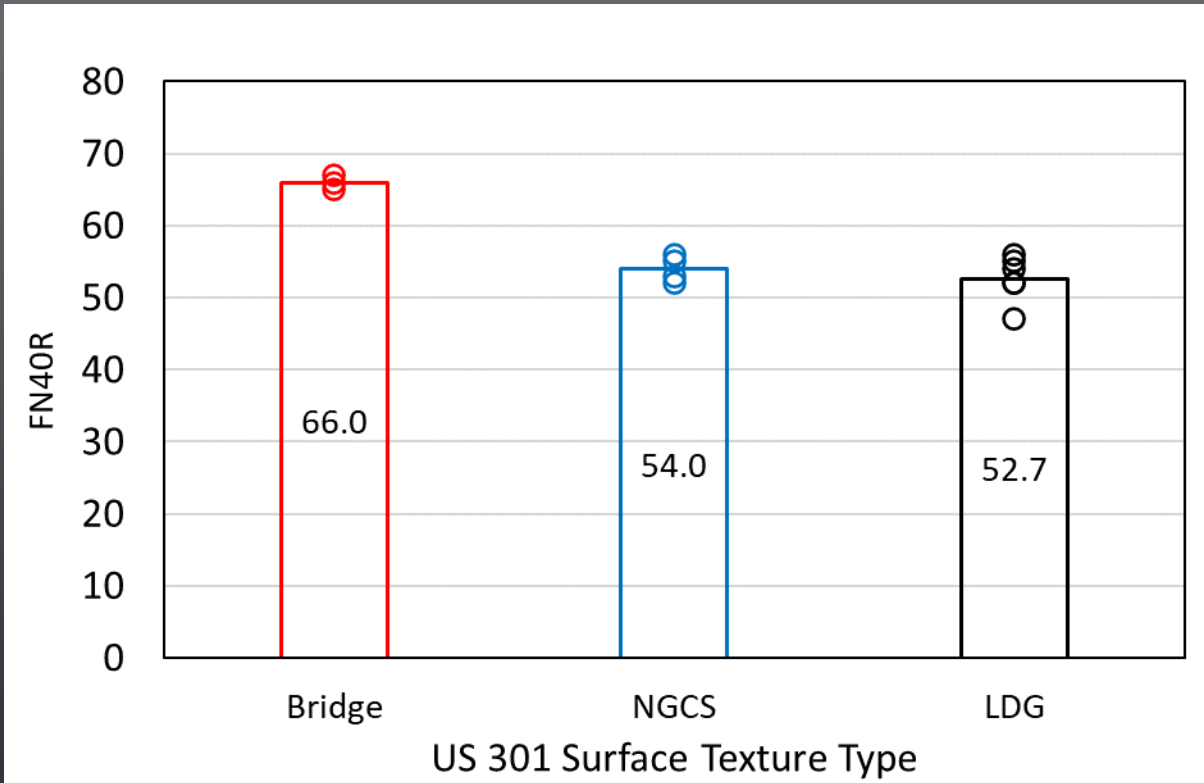


Smooth Tire

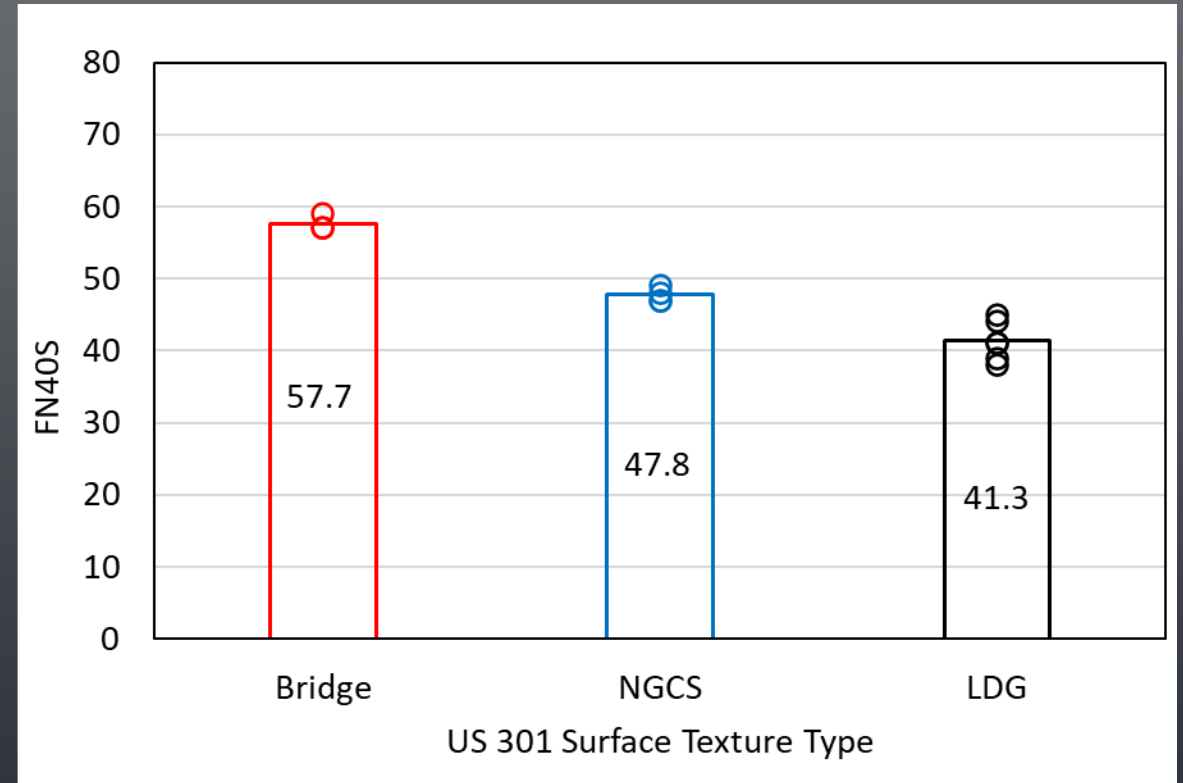


TEXTURE TYPE COMPARISONS OF FN40R/40S

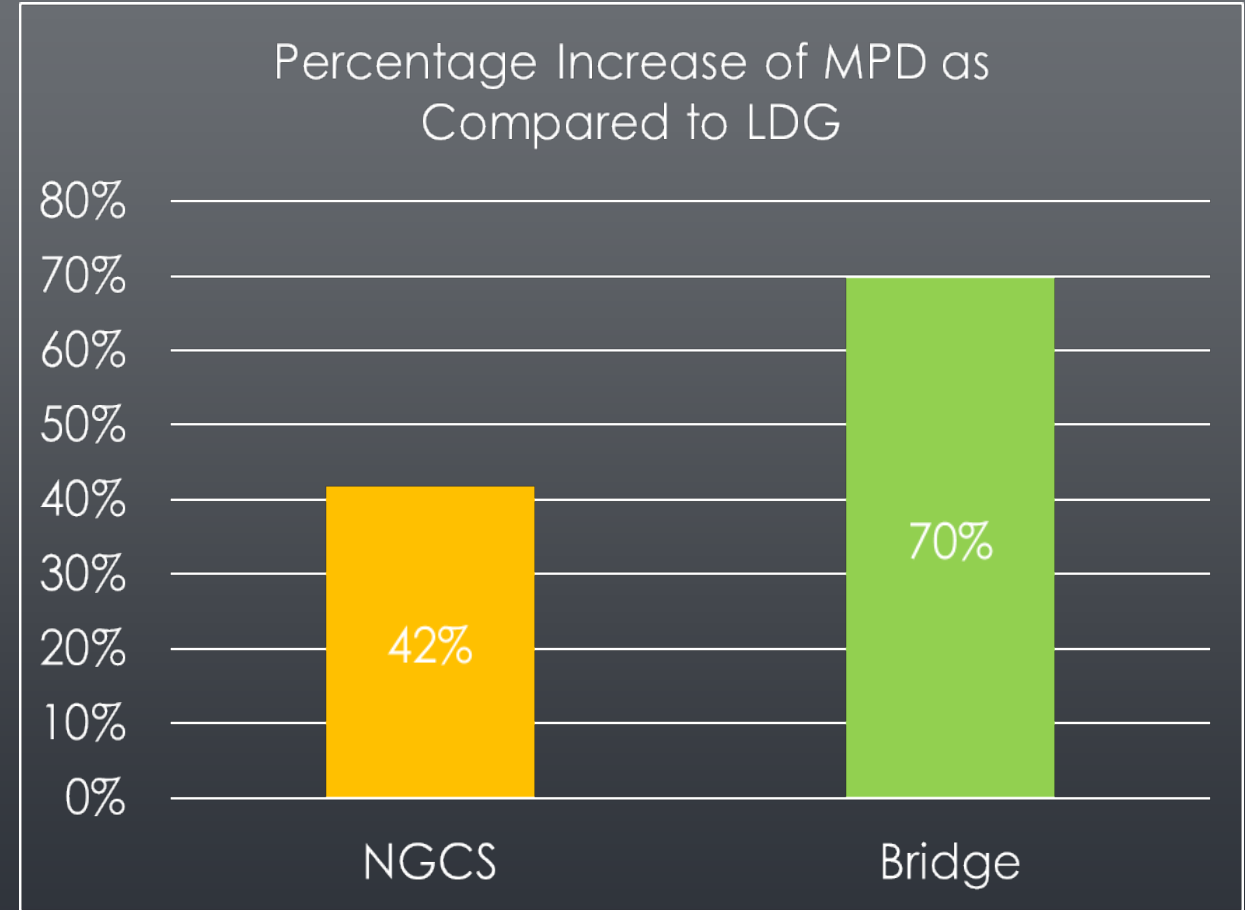
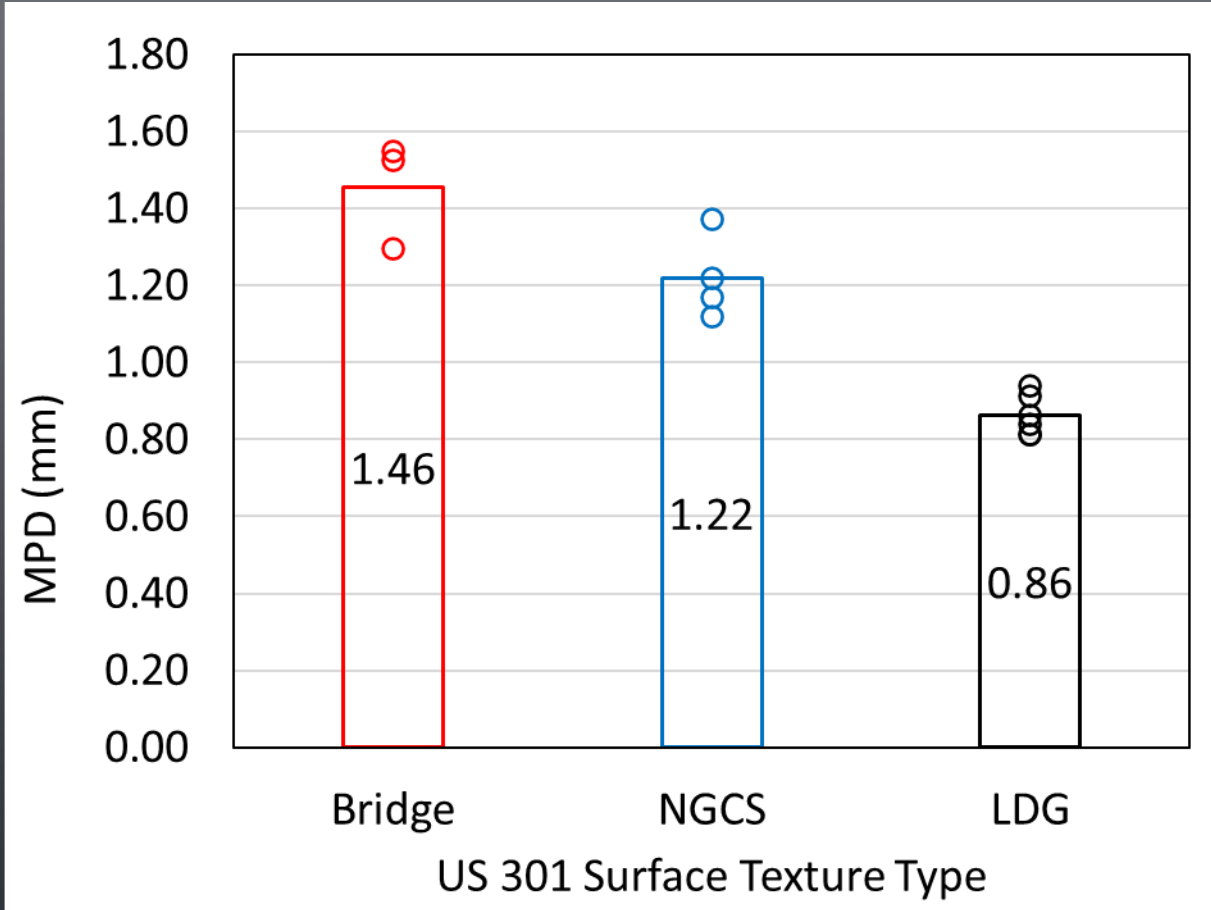
Ribbed Tire



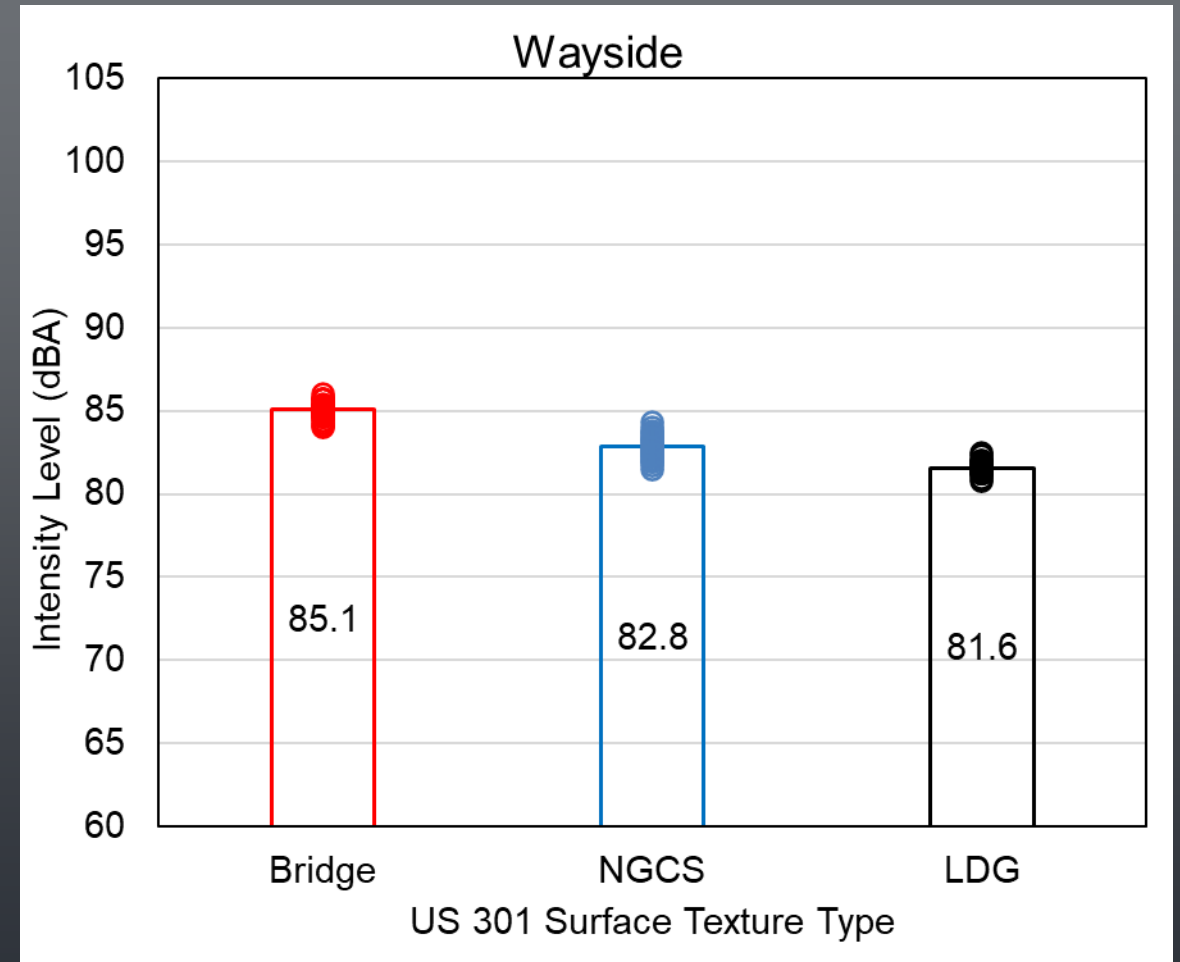
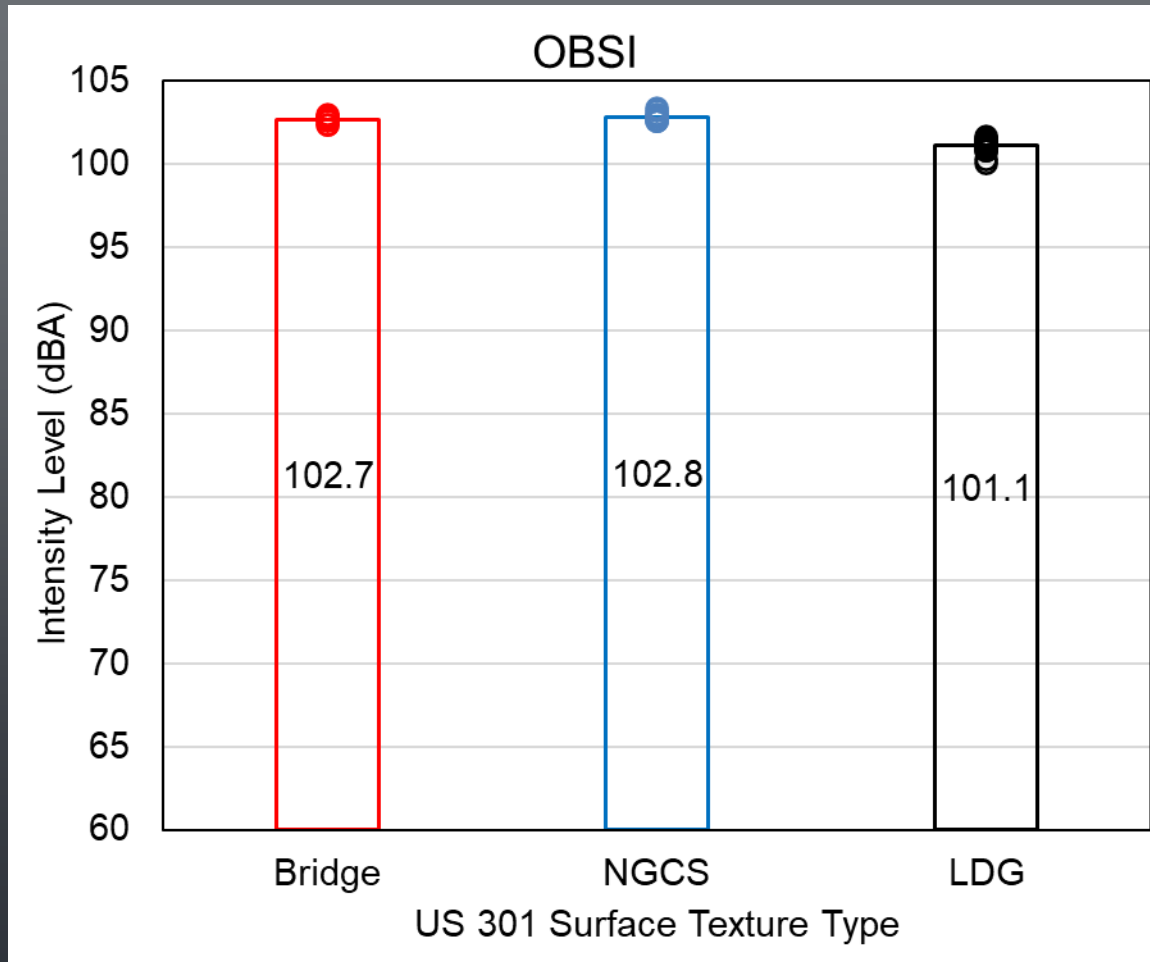
Smooth Tire



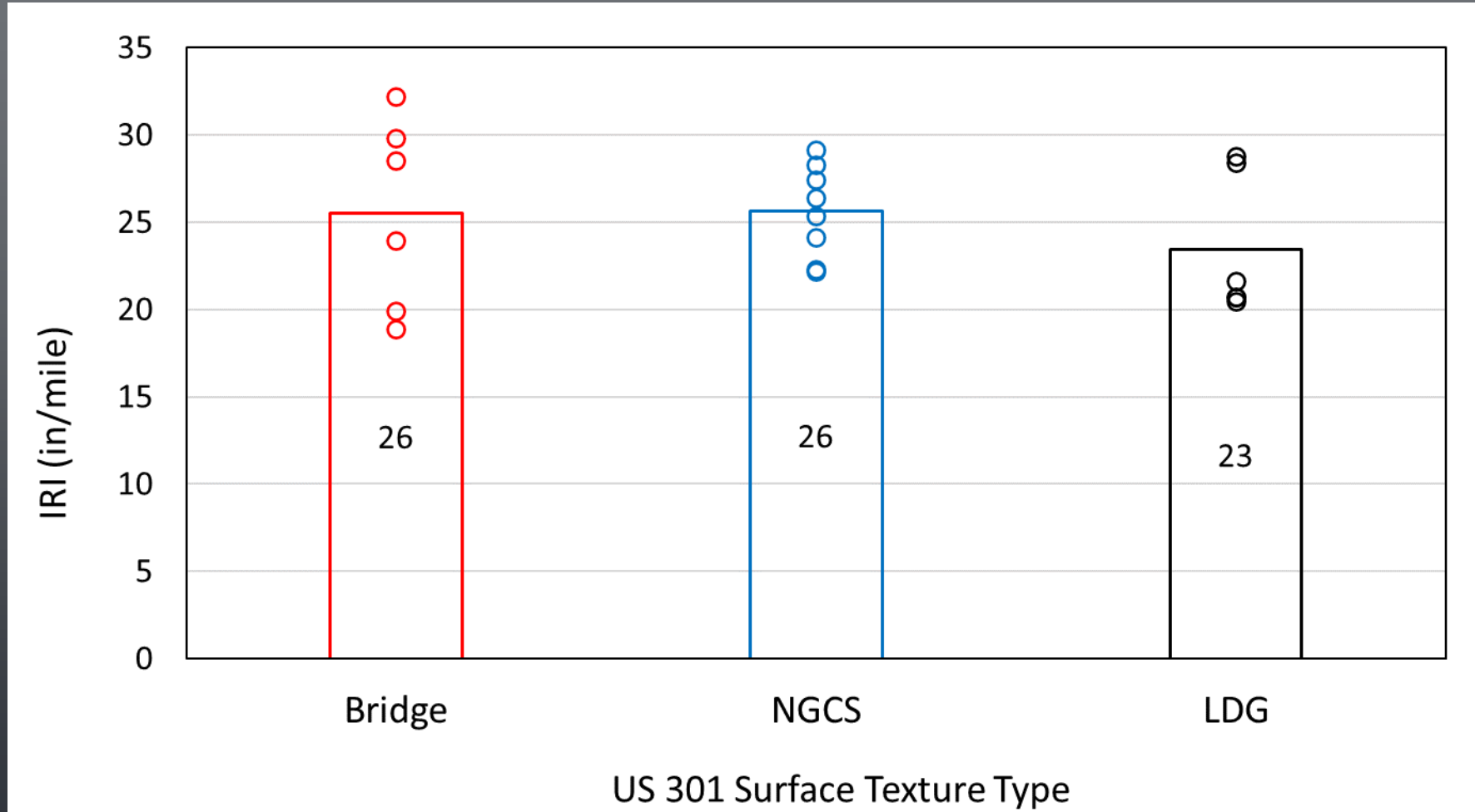
MACROTEXTURE AND MEAN PROFILE DEPTH (MPD)



TEXTURE TYPE VERSUS OBSI AND WAYSIDE NOISE



SMOOTHNESS (IRI)



SUMMARY-US 301 TEST ROAD

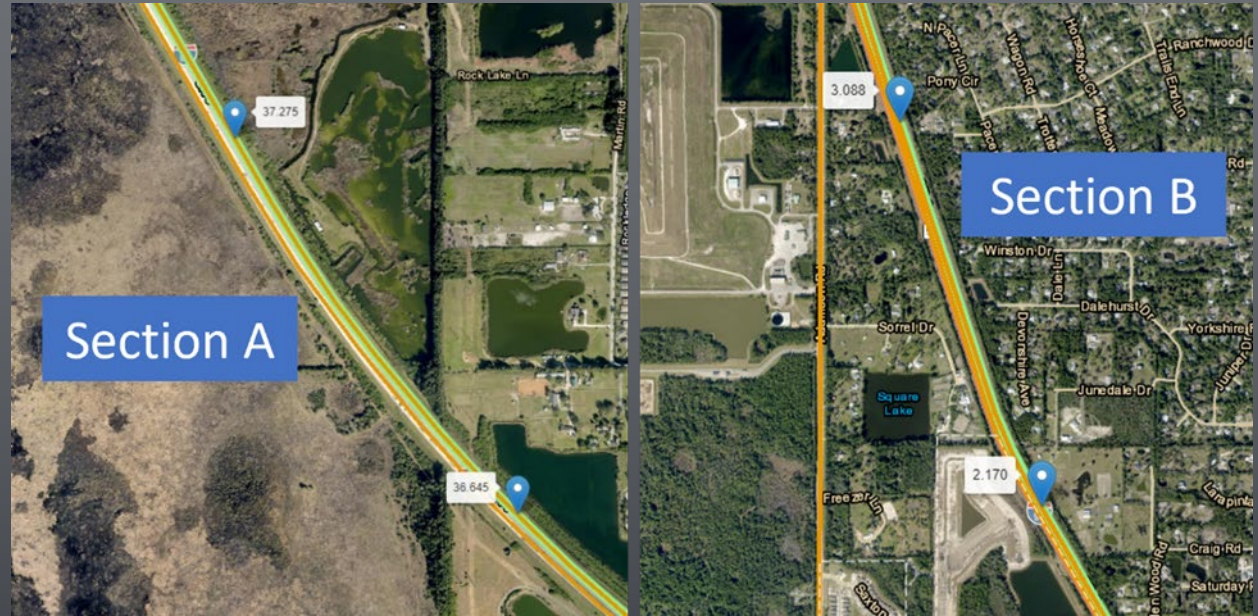


- RESULTS ARE BASED ON LESS THAN 1 YEAR OLD TEST SECTIONS.
- FRICTION-PERFORMANCE IS GOOD FOR ALL SECTIONS. BRIDGE (LDG/TG) HAS THE HIGHEST FN.
- FRICTION DECREASES WITH INCREASED TEST SPEEDS FOR ALL THREE CONCRETE TEXTURES.
- MACROTEXTURE-BRIDGE (LDG/TG) HAS THE HIGHEST MPD, FOLLOWED BY NGCS AND LDG.
- OBSI NOISE-DIFFERENCE AMONG 3 SECTIONS ARE WITHIN 1.7 DBA.
- WAYSIDE NOISE-BRIDGE (LDG/TG) HAS THE HIGHEST NOISE, FOLLOWED BY NGCS AND LDG.

I-95 LONGITUDINAL GROOVING PROJECT

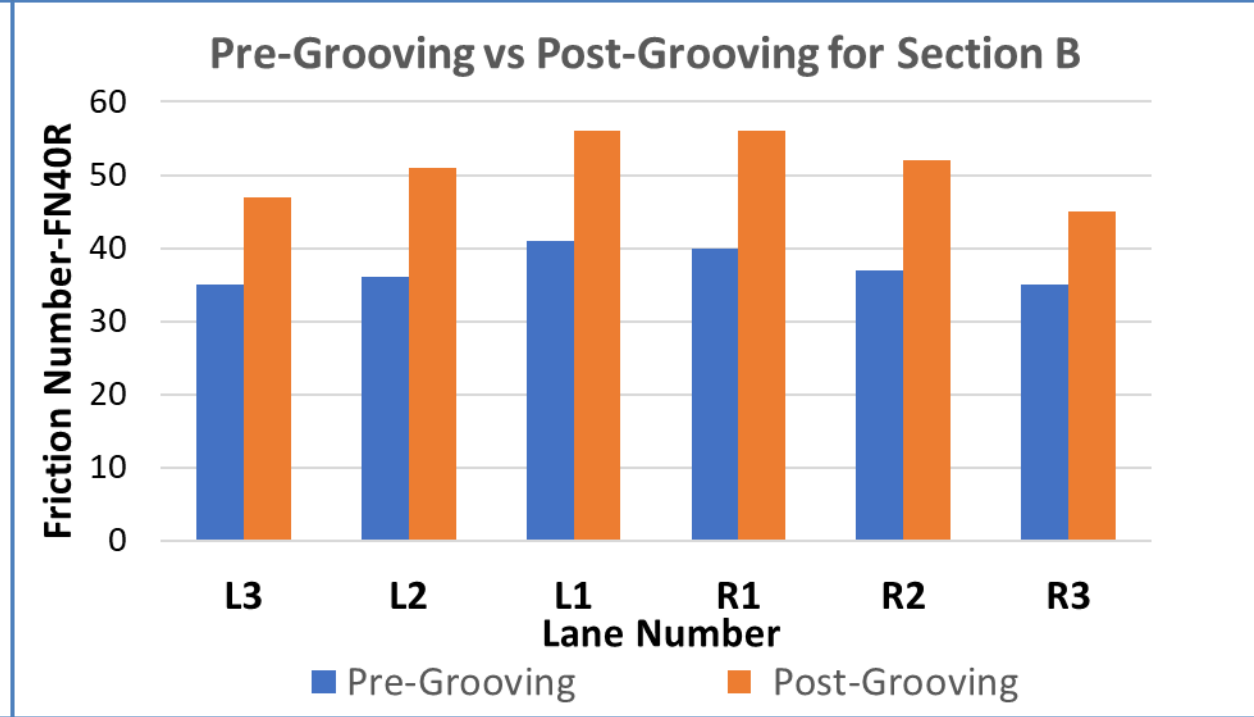
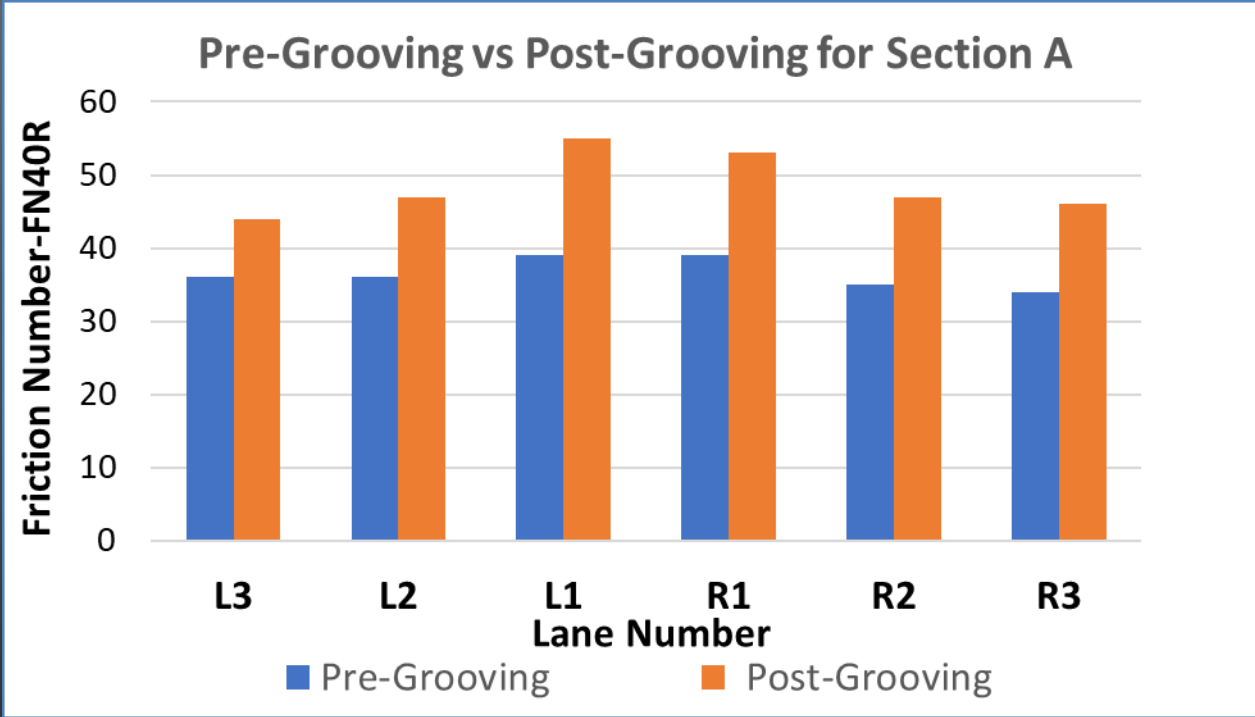


- I-95 in Brevard County, Florida
 - Section A 0.918 miles, Section B is 0.630 miles.
 - 70 mph Design Speed
 - 4 lanes
 - Work began on 09/13/22 and completed on 10/14/22



FRICITION PRE VS POST GROOVING

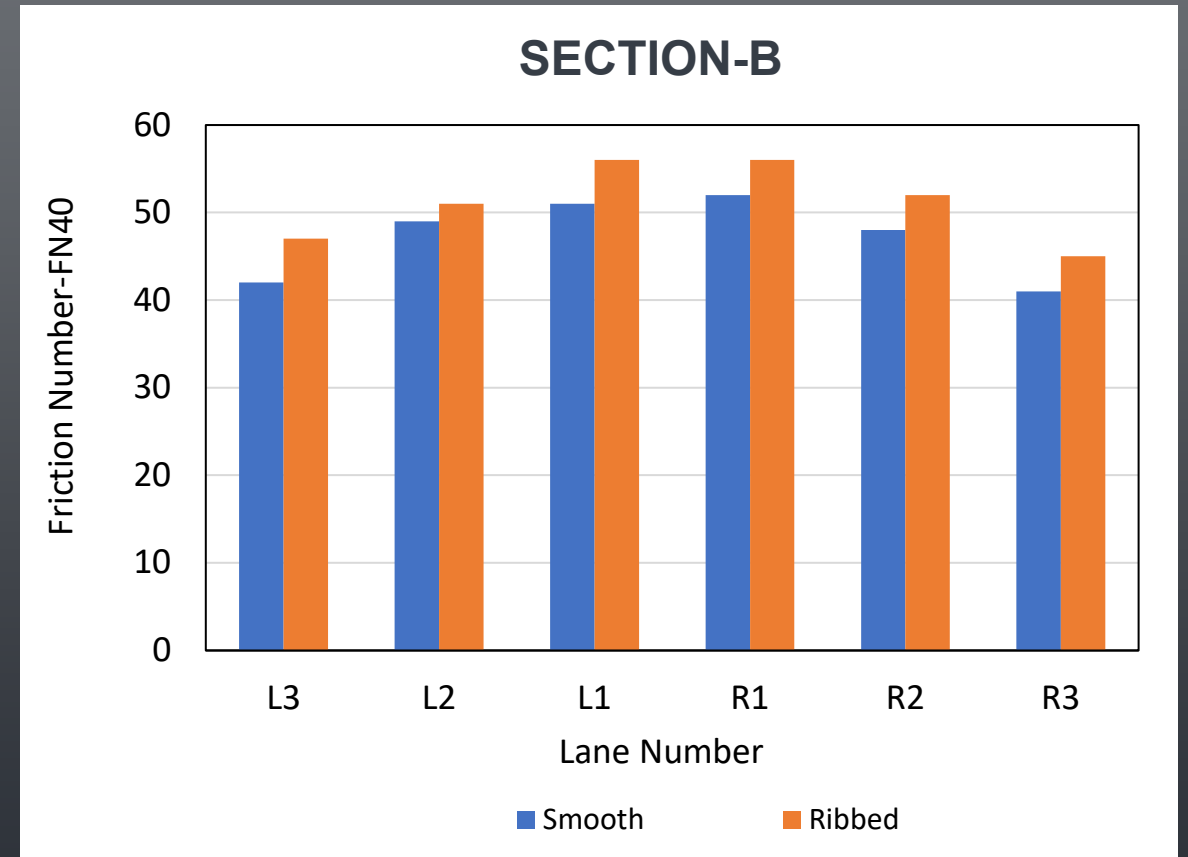
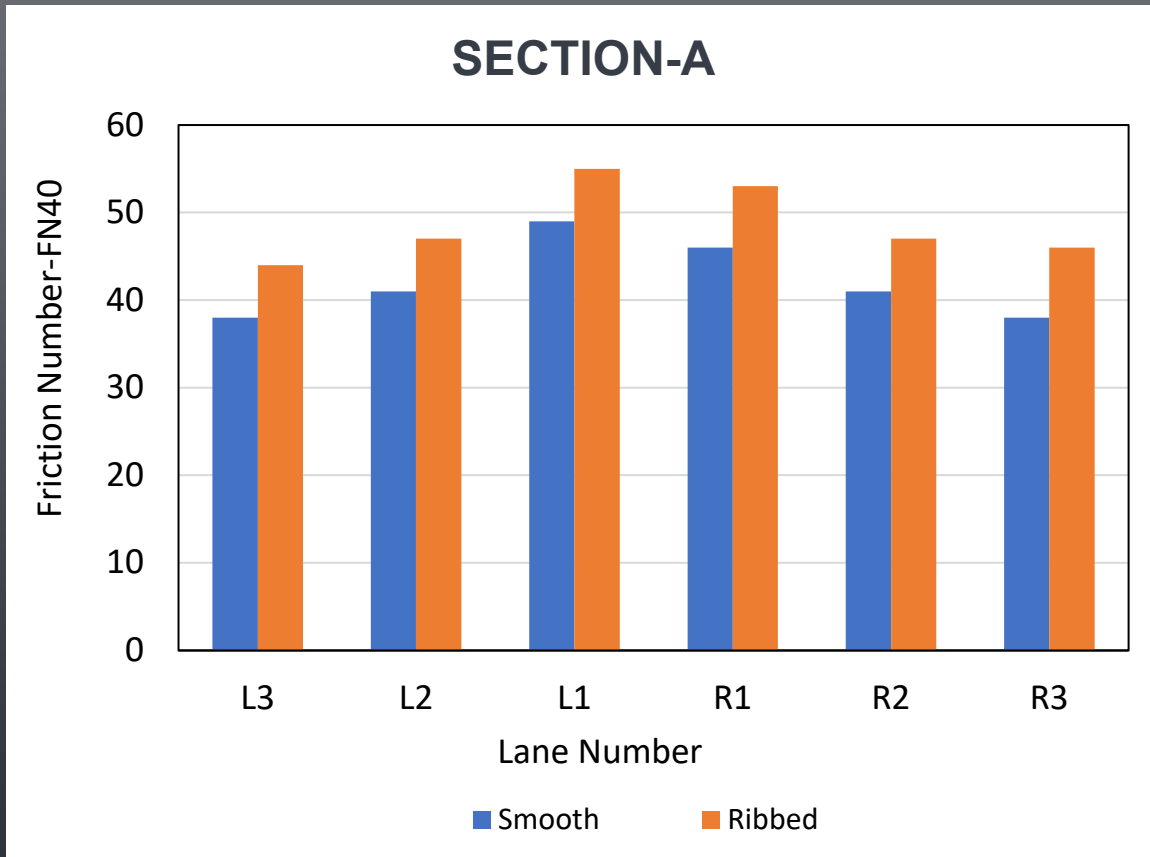
- Pre-Grooving Friction Numbers Mostly 30's
- Post-Grooving Friction Numbers Now 40's & 50's!
- 35% Increase in Friction



SMOOTH VS RIBBED

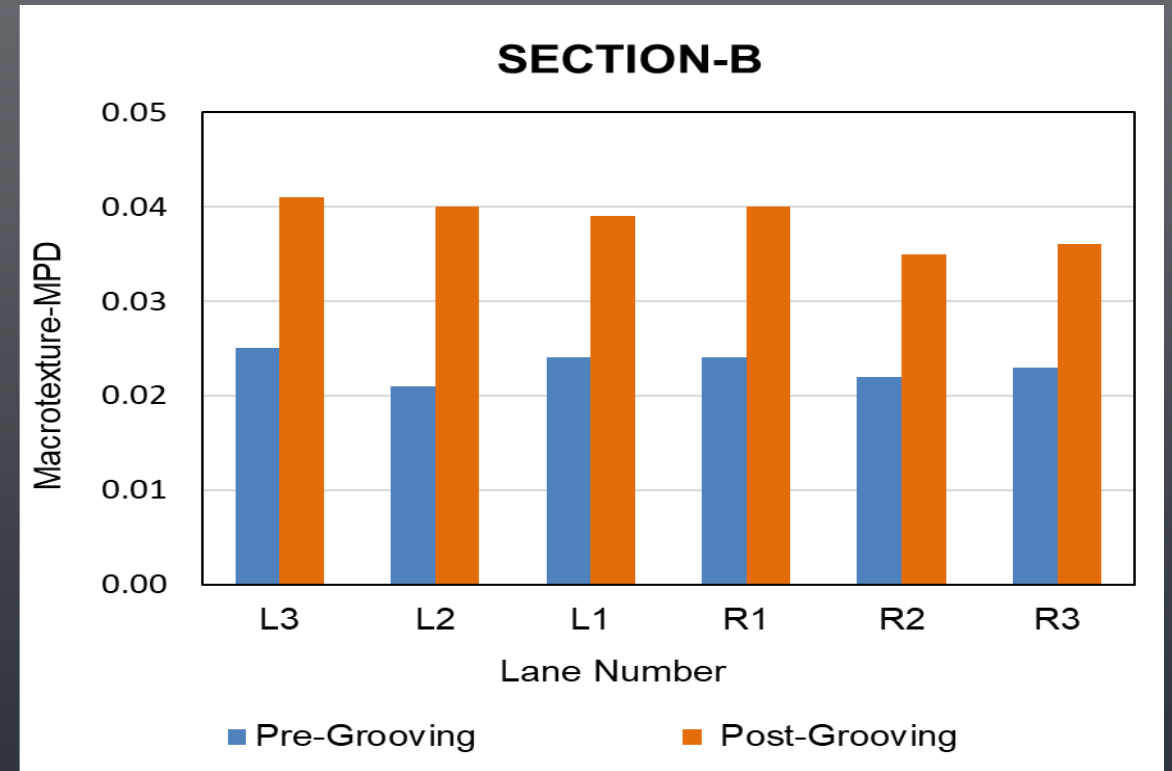
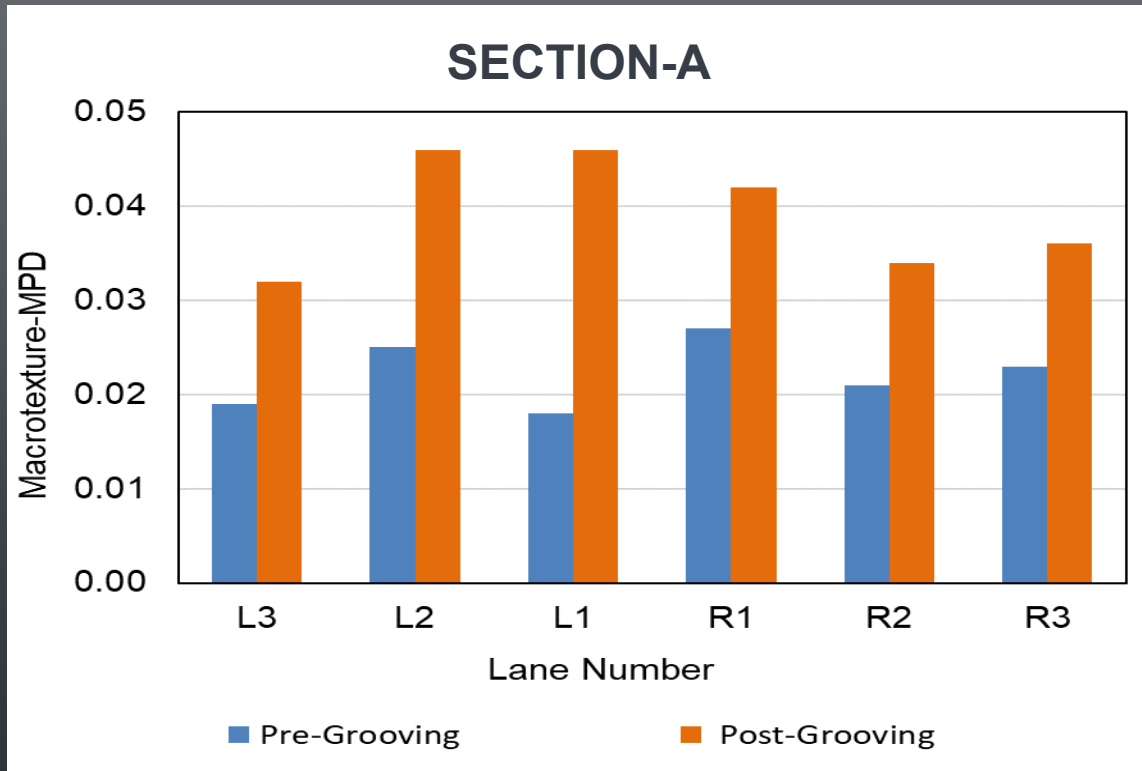


- Similar Results (Ribbed Tire vs Smooth Tire Friction)
 - Indicates Good Macrotexture & Hydroplaning Resistance



TEXTURE (MPD)-PRE VS POST GROOVING

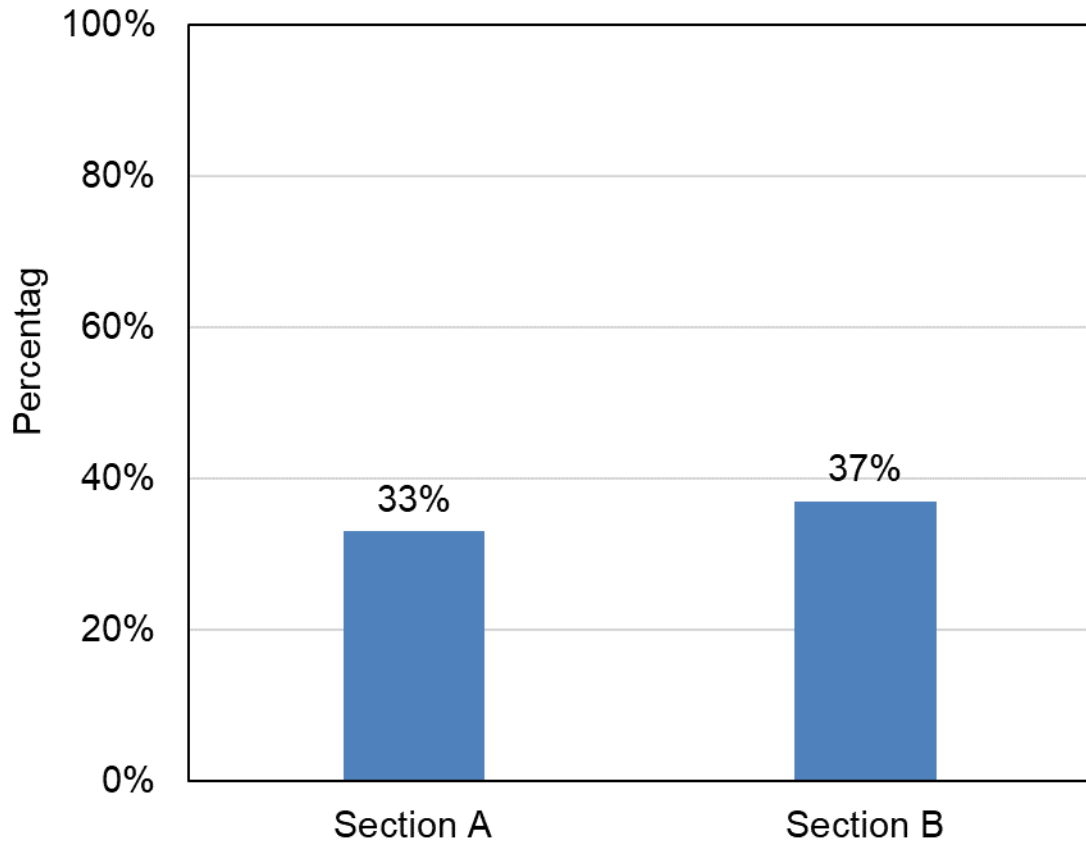
- Longitudinal Grooving Significantly Increased Macrottexture
 - Almost Doubled In Most Cases Indicates Good Hydroplaning Resistance



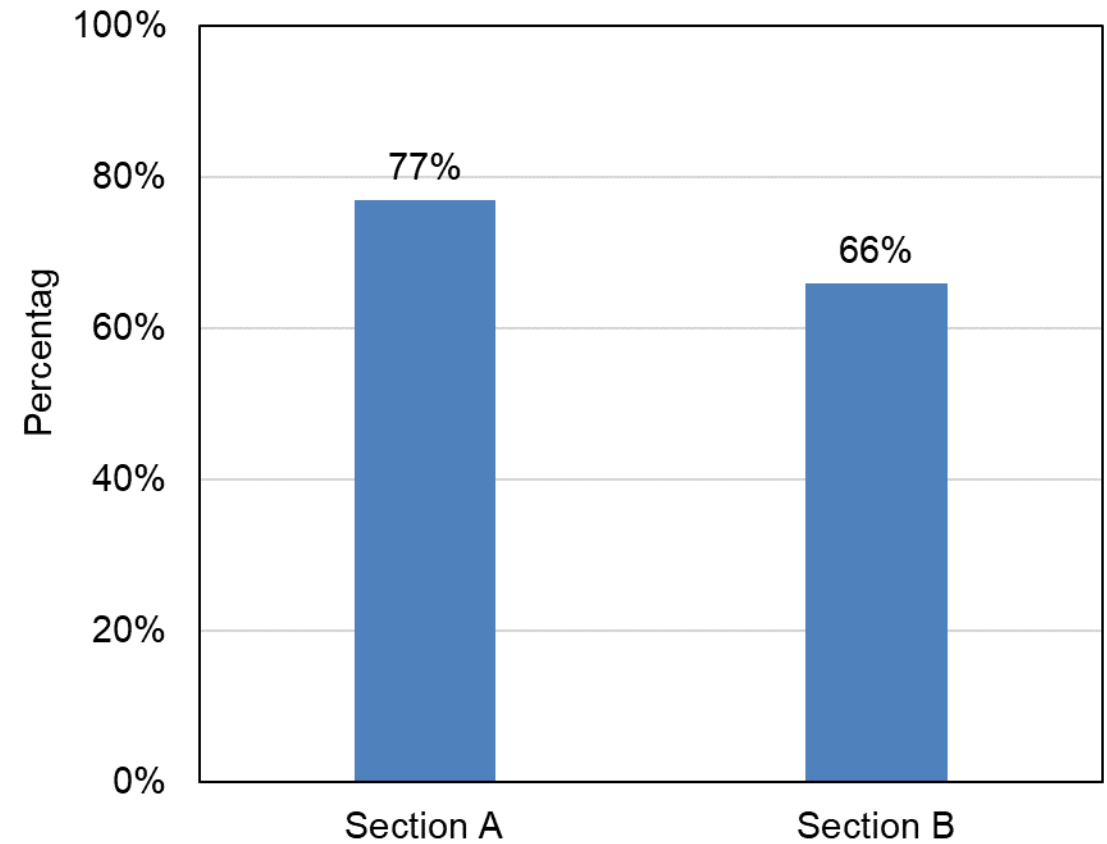
INCREASE PERCENTAGE



PAVEMENT FRICTION (FN40R)



PAVEMENT TEXTURE (MPD)



SUMMARY I-95



- BOTH FRICTION AND MACROTEXTURE WERE INCREASED SIGNIFICANTLY AFTER LONGITUDINAL GROOVING. ON AVERAGE, FRICTION WAS INCREASED BY MORE THAN 30% AND MACROTEXTURE IN TERMS OF MPD WAS INCREASED BY MORE THAN 60%.
- THE DIFFERENCE IN FRICTION BETWEEN RIBBED TIRE AND SMOOTH TIRE IS NO MORE THAN 15%, WHICH INDICATES LONGITUDINALLY GROOVING CONCRETE PAVEMENT PROVIDES GOOD MICROTEXTURE AND MACROTEXTURE.



QUESTIONS?